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Ability of Organic Guayusa Extract to Augment Mood, Desire to Exercise, and Exercise Performance in Young Adult Women

by

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ABSTRACT

Short Title: AMA consumption influences the desire to train and exercise performance in young adult females.

The United States energy drink market has grown exponentially since its debut in 1997 and is projected to double, increasing from $7.8 billion to $15.7 billion in the coming years. *Ilex guayusa* is a caffeinated holly species brewed similarly to *Camellia Sinensis* used to make green or black tea and contains a unique makeup of caffeine and antioxidants. Recently, companies have worked to demonstrate unique functionalities of Ilex guayusa in the form of organic guayusa extract (OGE), as a result, this ingredient has flooded the nootropic premium energy market. **PURPOSE:** The purposes of this project were to first determine the dosing efficacy of a form of OGE, AmaTeaMAX (AMA) on mood (Study 1), and then to investigate AMA's effect on the desire to train and exercise performance during a high intensity training program and subsequently on body composition changes (Study 2). **METHODS:** In Study 1, sixteen healthy, physically active, young adult females (mean±SD, age = 28±7) completed experimental visits in randomized order, during which they either consumed a moderate dose of AMA (AMA_{600}), high dose of AMA (AMA_{1200}), or a PLA. Following an hour-long rest and cognitive testing, participants took a 35-question survey (POMS-SF) created to assess mood states. In Study 2, thirty-three, physically active, young adult females (mean±SD, age = 24±7) completed two experimental visits and six weeks of chronic AMA_{600} supplementation alongside exercise training that consisted of two full body resistance training (FBRT) sessions and one metabolic conditioning (METCON) session. Desire to train was measured upon arrival to exercise training sessions using a 41-item exercise readiness scale and visual analog scales designed to address their desire to exercise right now and to invest physical and mental energy. Exercise performance

during exercise training sessions was measured as the total volume during the FBRT sessions and time to completion (TTC) during the METCON session and as well as their last set of FBRT where they performed as many reps as possible (AMRAP). Lastly, body composition was represented as the percent change in body fat (BF) from pre to post testing, measured using bioelectrical impedance. Statistical analyses included two-way (condition × time) ANOVAs or mixed-effects models to examine the effect of AMA on mood and the desire to train. Post-hoc one-way ANOVAs and pairwise comparisons were used to decompose interactions and main effects. For body composition analysis, ANCOVA models with baseline values as the covariate were utilized to maximize statistical power. **RESULTS:** In Study 1, acute consumption improved Total Mood Disturbance (TMD) in AMA_{600} when compared to PLA ($p = 0.023$), whereas AMA_{1200} did not ($p = 0.698$). Acute OGE consumption only positively affected Fatigue-Inertia in the AMA_{600} condition when compared to PLA ($p = 0.005$). In Study 2, a medium effect size was found ($d = 0.65$) in total volume lifted in AMA_{600} versus PLA, but this effect was not statistically significant ($p = 0.061$). There was a significant time effect for total volume ($F_{11, 343} = 52.78$, $p = < 0.001$) and TTC ($F_{5, 157} = 26.48$, $p = < 0.001$) as well as a significant ($p = < 0.001$) time effect in the third set (AMRAP), with trends in group differences ($p = 0.055$, $d = 0.66$). There was an interaction between time and group in the desire to exercise right now ($p = 0.024$). Interestingly, AMA_{600} had no change in desire to exercise right now throughout the study ($F_{17, 272} = 15.51$, $p = 0.139$), whereas PLA ($F_{17, 260} = 1.805$, $p = 0.028$) decreased their desire to exercise right now from week 1 through week 4 (all $p \leq 0.029$), oscillating the last two weeks. The desire to invest mental energy ($F_{17, 532} = 2.23$, $p = 0.003$) significantly decreased over the study, while the desire to invest physical energy tended to be higher in the AMA_{600} group when compared to PLA ($p = 0.071$). An independent-samples t-test was used to probe this potential group

difference, which indicated similar findings (36.3 ± 7.24 vs. 31.5 ± 8.43, $p = < 0.069$, $d = 0.611$). Our study found a significant interaction effect between time and group in relation to exercise readiness ($F_{17, 528} = 1.759$, $p = 0.030$). Further analysis revealed that exercise readiness did not significantly change across time for either AMA_{600} ($p = 0.055$) or PLA ($p = 0.081$) groups, however, exercise readiness was significantly different between AMA_{600} and PLA on week 2 day 2 ($p = 0.043$). Finally, there was no significant difference in body composition ($F_{1, 30} = 0.535$, $p = 0.535$, partial $n^2 = 0.040$) or FM ($F_{1, 30} = 0.365$, $p = 0.550$, partial $n^2 = 0.012$). Though, changes in FFM tended to be higher in AMA_{600} compared to PLA ($F_{1, 30} = 3.203$, $p = 0.084$, partial $n^2 = 0.096$). **CONCLUSION:** In conclusion, our data indicates that acute AMA_{600} supplementation is independently associated with improved mood and desire to train and tends to increase total volume lifted as well as AMRAP performance when compared to placebo with no effects on body composition.

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PUBLIC ABSTRACT

The United States energy drink market has grown exponentially since its debut in 1997 and is projected to double, increasing from $7.8 billion to $15.7 billion in the coming years. Recently, companies have worked to develop new “organic" tea-based products, such as organic guayusa extract (OGE), or in this case, AmaTea MAX (AMA), and market them as nootropics. As nootropics are proposed to improve mood, function, and performance, the purpose of the first study is to test various doses of AMA on mood, then, take the most efficacious dose and investigate its role in the desire to train, a function of mood, and determine its role in improving exercise performance throughout a six-week high intensity training program. Likewise, as exercise is known to promote shifts in body composition, we aim to measure the direct and indirect impacts of supplementation on body composition. We found that AMA_{600} supplementation improved mood and supported a higher desire to train and tended to influence performance in resistance exercise when compared to those who weren’t supplementing. Furthermore, we found no effect of supplementation on body composition. These findings are significant as we can begin to understand the benefits of consuming AMA_{600}, especially its potential ability to improve the desire to train and exercise performance. However, more studies are needed to fully understand AMA’s ability to influence mood, the desire to train and exercise performance, and how that may impact body composition.

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I. LITERATURE REVIEW

I.A. Overview

This literature review aims to outline the potential for Organic Guayusa Extract (OGE) to augment mood, desire to exercise, exercise performance and body composition in young adults. *Ilex guayusa* (e.g., OGE) is a caffeinated holly species that grows only in the upper Amazon basin of Columbia, Ecuador, and Peru (Dueñas, 2016). Guayusa is brewed similarly to *Camellia Sinensis* used to make green or black tea and contains a unique makeup of caffeine and antioxidants. International commercialization and marketing of Guayusa first began in 2010 and is primarily controlled by the United States (Krause & Ness, 2017). Recently, companies have worked to demonstrate unique functionalities OGE, as a result, this ingredient has flooded the nootropic premium energy market. Nootropics are a chemically diverse class of compounds reported to support mood (Medrano et al., 2022) in otherwise healthy individuals. Consequently, OGE has been proposed to enhance mood (Bloomer et al., 2022; Krieger et al., 2016) which is a predictor of athletic performance (Lochbaum et al., 2021). Thus, it plausible that OGE supplementation, by enhancing mood and the desire to train, may also augment performance during exercise training and thereby promote greater adaptations during a chronic training program. This review will illustrate the relationship between OGE supplementation and its purported benefits.

I.B. Properties of *Ilex guayusa*

Studies assessing the properties of *Ilex guayusa* began around 2016 with Kapp *et al*. describing the general and genetic toxicology of guayusa concentrate, noting that *Ilex guayusa* contained high levels of both caffeine (36 mg/g) and chlorogenic acids (42 mg/g) (Kapp et al., 2016). This was further supported by work from Garcia-Ruiz *et al*. (2017) and Villacis-

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Chiriboga *et al.* (2018), who determined that *Ilex guayusa* contained significant amounts of chlorogenic acids (CGA) (24 mg/g), isochlorogenic acids (16 mg/g) and neochlorogenic acids (8 mg/g) (Garcia-Ruiz et al., 2017; Villacis-Chiriboga et al., 2018). In addition to caffeine and CGA, traditional guayusa contains several dietary phenolic compounds known as catechins. The catechins contained in guayusa are epicatechin (0.179 mg/mL), epicatechin gallate (ECG) (0.199 mg/mL), epigallocatechin gallate (EGCG) (0.0876 mg/mL), and epigallocatechin (EGC) (1.11mg/mL). The total catechin content (2mg/ml) in *Ilex guayusa* is 18 - and 21 - fold lower in comparison to caffeine and chlorogenic acids, respectively. Notably, both CGA and catechins are powerful antioxidant (Cha et al., 2014; Garcia-Ruiz et al., 2017) and anti-inflammatory molecules (Liang & Kitts, 2015; Pardau et al., 2017) that scales with dosage. Traditional guayusa contains about 2.4% CGA and has been found to have nearly half of the scavenging capabilities of traditional *Camellia Sinensis* (i.e., green tea) and thus affords about 60-80% protection from oxidative damage produced by reactive oxygen species as measured by assay (Pardau et al., 2017). However, AmaTea MAX (AMA), a new formulation of OGE, is uniquely standardized to CGA content (~30%, ~180 mg) while maintaining caffeine (~20%, ~200 mg) and catechin content (~5%, ~30 mg). This 4-fold increase in CGA content with similar levels of caffeine and catechins potentially affords greater antioxidant and anti-inflammatory capabilities when compared to traditional guayusa and guayusa extracts.

I.C. Rationale for OGE Supplementation to Support Exercise Training

Initial methods for determining exercise readiness, or the desire to train, were limited to specific training paradigms like flexible non-linear periodization (FNLP) (Kraemer & Fleck, 2007). In the context of FNLP, the desire to train was perceptually gauged by the trainee and used to assign intensities such that low-intensity workloads are applied in response to a low